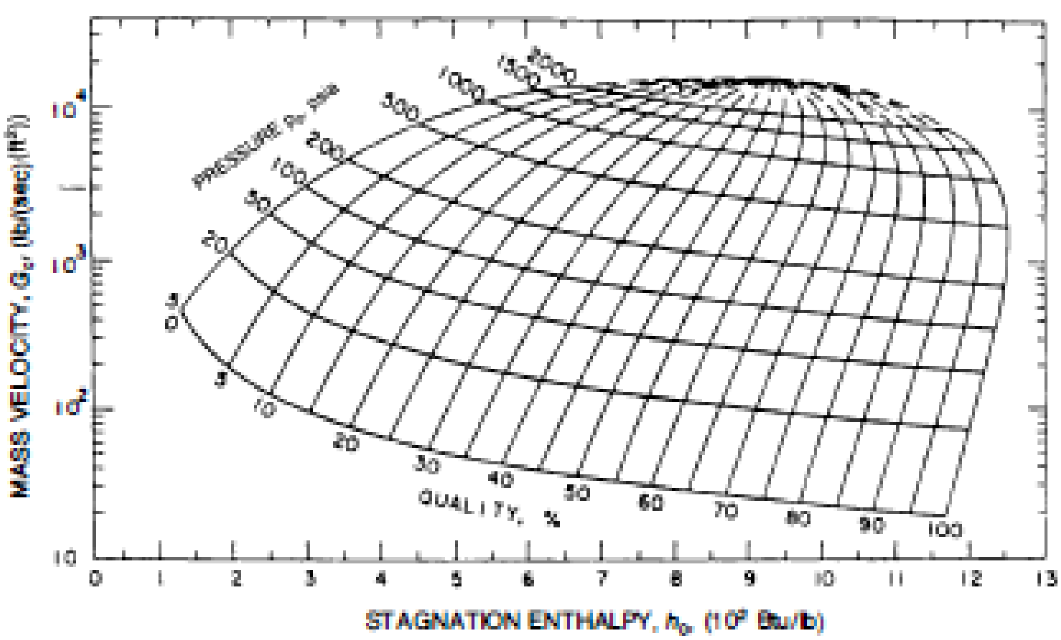
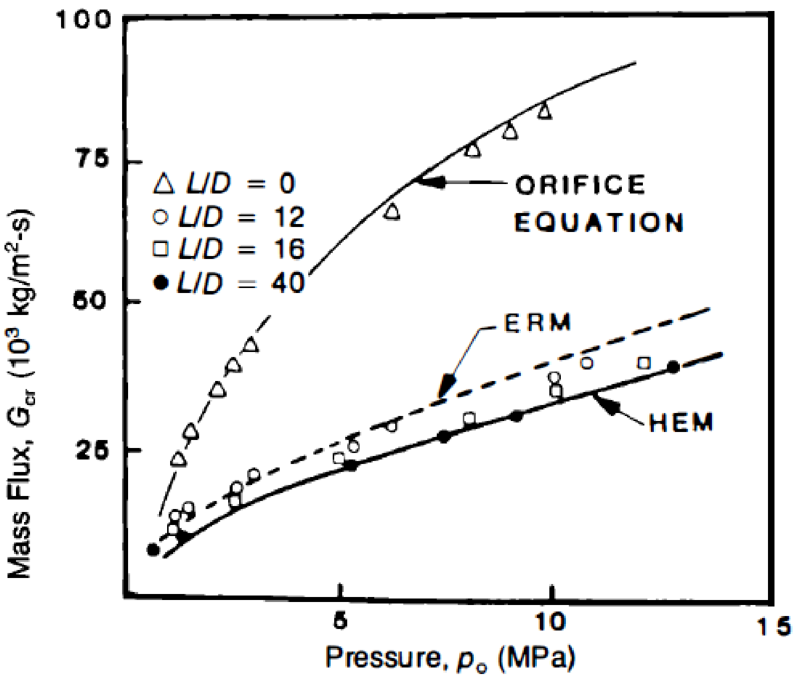
EN 634 Nuclear Reactor Thermal-Hydraulics
Assignment -8

1. (a) Differentiate Eq. (6) in Slide 7 and obtain the condition given in Eq. (7).
   (b) Performing necessary algebra, show the result arrived in Eq.(9) in slide 9
2. Starting from the definition of the specific kinetic energy (kinetic energy per unit mass flow rate) as, $\left(xu_g^{\,2}+(1-x)u_l^{\,2}\right)$,
   Show that for unit mass flow rate and given quality, the above term will be minimum for the slip given by $s=\left(\frac{\rho_l}{\rho_g}\right)^{\frac{1}{3}}$. (To show this express u_g and u_l in terms of total mass flux, densities, quality, and void fraction. Now express void fraction in terms of x and s. Now take a partial differentiation with s and equate to 0 and get the desirable result.
3. Starting from the definition of the specific momentum (momentum per unit mass flow rate) as, $\left(xv_g+(1-x)v_l\right)$,
   Show that for a unit mass flow rate and quality, the above term will be minimum for the slip given by $s=\left(\frac{\rho_l}{\rho_g}\right)^{\frac{1}{2}}$. Proceed similarly as in the previous problem

4. Develop an Excel sheet for the prediction of critical mass flux using homogeneous, Fauske's and Moody's models. You can use the Excel steam table available with you. Get your results for a few p_0 and h_0 spanning the domain given in the original reference of Fauske given in the next page and compare your solution with it. (Note that the coding for homogeneous model, Moody's model and Fauske's model would be identical except for the definition of 's'). For homogeneous model, you can compare with the results given later





100
75
50
25
△ L/D = 0
○ L/D = 12
□ L/D = 16
● L/D = 40
ORIFICE
EQUATION
ERM
HEM
Mass Flux, G_{cr} (10^3 kg/m^2-s)
5
10
15
Pressure, p_o (MPa)